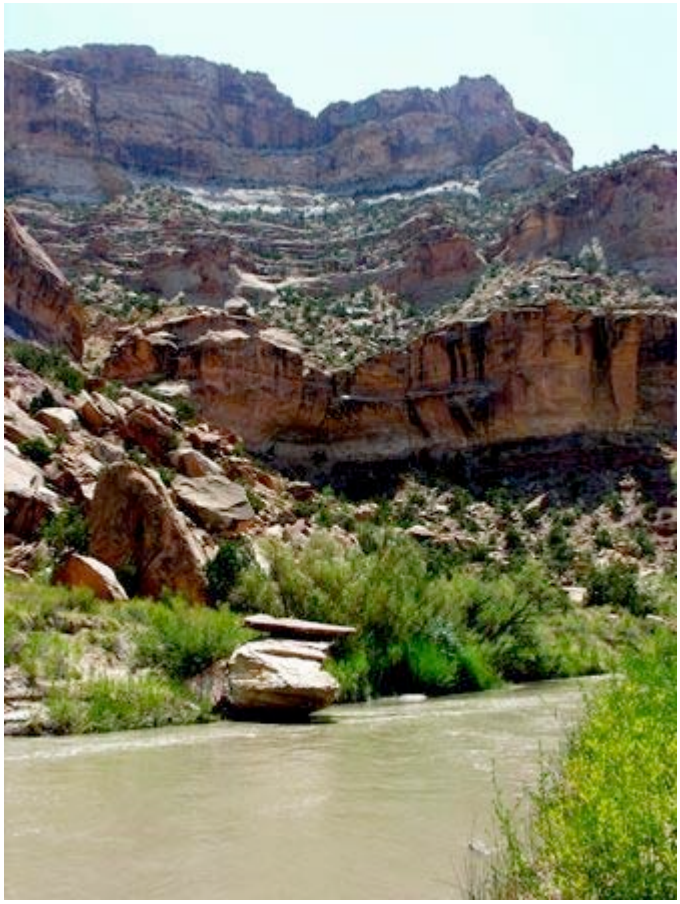
San Rafael Rapid Response Plan
Draft

Guidance for containing and controlling Aquatic Invasive Species (AIS) within the San Rafael Drainage.

March 09, 2009



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Background:

Quagga (*Dreissena bugensis)* and zebra mussels (*Dreissena polymorpha)* are not native to North America; they first found their way to the Great Lakes area in the ballasts of transoceanic ships during the mid 1980s. Since their introduction, they have spread widely across midwest and eastern states, creating a wake of destruction everywhere they invade.

Zebra mussels and their close relative quagga mussels (both Dreissenid spp.) have cost billions of dollars in damages by clogging water pipes, degrading water quality, and competing with fish populations. Western states have observed all of this from a distance hoping that somehow these troublesome mussels would never reach western waters. Unfortunately, in January of 2007, quagga mussels were found in Lake Mead and shortly after they were found in reservoirs of the lower Colorado River, including Lakes Mohave and Havasu. Dreissenid mussels have also been detected in various waters in Colorado, (Lake Pueblo, Lake Granby, Shadow Mountain, Jumbo Reservoir also known as Julesburg Reservoir, and Tarryall Reservoir) Lake Pleasant Arizona, and San Justo California.

Taking a proactive approach the Utah Division of Wildlife Resources (UDWR) and its partners worked diligently to keep quagga and zebra mussels out of Utah during the 2008 boating season. During the 2008 boating season, Utah's Aquatic Invasive Species (AIS) program interdicted 71,317 pre-launch boaters at 38-43 high use waters, which resulted in 818 professional decontaminations using 140 degree F water. Surveys of nearly 8,000 boaters showed that 89% are aware of the Dreissenid mussel threat to Utah and that they need to decontaminate.

Decontamination protocol

If a boater completes the do-it-yourself decontamination they are deemed clean and free to launch (see below). If they have been in an infested water body more recently than the recommended drying time, and have not self decontaminated, then the law requires them to have their boat professionally cleaned. This is why the UDWR technician's man boat ramps asking people where they have been boating in the last 30 days. If a boater is found to be in need of a professional decontamination UDWR can do that for them at the lake (free of charge) and then allow them to launch.

Do-it-Yourself Decontamination: Boat owners must clean and drain their boat and equipment as they leave a water body, then dry it for an appropriate amount of time between boating trips at home.

· Clean mud, plants, animals or other debris from boat or equipment;

· Drain the ballast tanks, bilge, livewells, and motor;

· Dry boat and equipment for 7 days summer, 18 days spring or fall, or freeze the boat and equipment in winter for 3 days;

OR

Professional Decontamination: Utah Division of Wildlife Resources' staff, including authorized volunteers, Utah Peace Officers, which includes Conservation Officers and state Park Rangers, and Utah Department of Transportation Port of Entry Agents, under authority of the Utah Aquatic Invasive Species Interdiction Act, and other properly trained persons, will decontaminate boats and equipment infested with AIS as per established protocols. (Wash the trailer and boat inside and out, including flush ballast tanks, bilge, livewells and motor with high pressure, 140 degree scalding water).

Early detection monitoring

Early-detection monitoring was a large part of Utah's AIS program effort. After sampling water in lakes and reservoirs statewide, the UDWR sent 54 samples to an independent lab for microscopic analysis. Initially 32 water bodies were sampled, some of the 54 samples sent to the lab were duplicate samples taken from water bodies and sent to the lab at different times. Preliminary test results indicated several waters might contain microscopic veligers, which are the early-life stages of zebra and quagga mussels.

UDWR's current protocol for determining an infested water requires three steps:

1. Visual observation of the mussel, which can include cross-polarized light microscopy for veligers; followed by positive findings via tissue analysis through two independent PCR methods.
2. UDWR uses the Wood/Kelly ribozomal DNA method, assessing the ITS I region.
3. The DeLeon/Rochell mitochrondrial DNA method, assessing the COX I region.

Once a visual observation of a Dreissenid mussel occurs, including microscopic, or a single PCR indication of a positive finding occurs, or both, the water body is held in the "inconclusive, needing more testing" classification until verification by the above protocol. If results from observation and PCR analysis remain negative for an entire second field season, the water can be considered for release from the "inconclusive, needing more testing" classification. A final process for release from that classification is still being formulated through discussion with other states and Dreissenid mussel experts.

UDWR management protocol for waters classified as "infested" or "inconclusive, needing more testing" will be to interdict all departing boats and make sure that education and decontamination occurs. We will continue to interdict arriving boats and provide an educational message and inspect those watercraft, but a focus on departing boats is

important so Dreissenids are not spread. Waters defined as "inconclusive, needing more testing" are also referred to as watch waters, meaning that microscopic young have been identified under a microscope but have not been confirmed by two independent DNA tests. (See Appendix A for state wide sampling results)

December, 08 2008 the Utah Wildlife Board acted to list Electric Lake, situated in Emery County, Utah about 22 miles west of Huntington City at the headwaters of the Right Fork of the Huntington River as the State's first water infested with Dreissenid mussels. Zebra mussels have been confirmed via observation of veligers by cross-polarized microscopy followed by molecular PCR analysis using two independent methods, of which one assesses nuclear DNA and the other assesses mitochondrial DNA.

Most recently, UDWR's contracted lab has now confirmed via two independent PCR tests that the veligers earlier viewed under the microscope at Red Fleet Reservoir are quagga mussels. UDWR will soon present this information to the Utah Wildlife Board for a formal change to Rule R657-60 to include Red Fleet Reservoir in Uintah County as a Dreissenid infested water body.

In 2008, the Utah legislature unanimously passed the state rule R657-60-1. The purpose of this rule is to define procedures and regulations designed to prevent and control the spread of aquatic invasive species within the State of Utah. R657-60-1 bestows a legal responsibility on the boat owner stating that "A person shall not place any equipment or conveyance that has been in an infested water in the previous 30 days into any other water body or water supply system in the state without first decontaminating the equipment or conveyance".

The Utah Aquatic Invasive Species Act, codified as Chapter 27 of Section 23 in the Utah Code and Rule R657-60 provides authority to Utah Division of Wildlife Resources in the event of infestation by a *Dreissena* species in part as follows:

1. To close ingress and/or egress at a water body, facility or water supply system to terrestrial or aquatic vehicles and equipment capable of moving *Dreissena* species for protection of Utah from their spread; and
2. To maintain the closure until an acceptable plan for containment and/or control of the *Dreissena* species is developed and implemented by the water body operator.

Forming a Response Team/ Scoping

In accordance with state rule R657-60-8 a plan which has been given the term "rapid response plan" must be implemented in order to control and contain the zebra mussels detected in Electric Lake. It was decided in early meetings that a response plan to deal with zebra mussels in Electric Lake would need to take a drainage wide approach. With the other "watch waters" in the drainage it does not make sense to write a plan specifically for Electric Lake, or any other water body. Little boats often jump around to several waters surrounding Electric Lake in a single day. Also, in some cases the irrigation water can be transferred from one basin to another via canals and pipes (Joe's Valley to Huntington North). Further more, Electric Lake drains into Huntington North

giving that reservoir a very high likelihood of becoming infested. For these reasons, a plan that discuses control methods and prevention of spread needs to incorporate the whole drainage. For this plan the area designated as the San Rafael drainage will be the area of focus (Fig. 3).

A scoping process conducted by the UDWR identified numerous partners that would have a vested interest in participating in the development of a rapid response plan. Appendix B is a list of the agencies and individuals that were invited to participate in the first meeting held on January 14, 2009.

Individuals invited were selected to represent their particular agency, company, or interest group. As expected when scoping for stakeholders in such a wide scale plan (San Rafael drainage) that affects many different user groups, it becomes difficult to create an all inclusive invitee list. For this reason, invitees were encouraged to spread the invitation to others within their agency or the general public that may have an interest in developing a rapid response plan. Our first meeting on January 14, 2009 was well attended by a diverse group of professionals and citizens willing to lend their resources to the development of a plan. For future reference a list of individuals present at the first meeting is included in Appendix C.

At the first meeting all relevant background information was presented on the AIS program and the findings at Electric Lake. One of the major tasks of this first meeting was to identify a sub team that would be the actual group of writers. It was agreed that this sub team would represent the larger group and once a draft was completed the plan would be submitted to the whole group for a review and comment period. The process of writing a draft, submitting it for review, and incorporating any needed changes will be completed as many times as necessary until the sub team comes to a consensus on the completion of the plan. The individuals that where selected to represent their agency or industry are listed below. For the rest of the plan the sub team will be referred to as the San Rafael response team. It was also decided that the plan needs to be finished by the end of March, 2009 in order to hit the ground running before the ice comes off our lakes and reservoirs.

San Rafael Response Team

1. Cody Allred	Pacificorp (Rocky Mtn. Power)
2. Sherrel Ward	President of Huntington Clevland Irrigation Company
3. Darrel Leamaster	Castle Valley Special Service District
4. Russ W. Findlay	Bureau of Reclamation
5. Jay Mark Humphrey	Emery County Water Conservation District
6. Daniel Gunnell	San Rafael Conservation District
7. Dan Richards	State Parks (Manager of Scofield, Huntington N., Millsite)
8. Rudy Sandoval	Forestry Fire and State Lands
9. Rod Player	U.S. Forest Service

Under state rule the UDWR is given the responsibility for leading the collaborative effort of writing the rapid response plan and Daniel Keller of the UDWR was selected as the team leader.

At the first meeting of the San Rafael response team all members were asked to create a list of concerns that needed to be addressed in the plan. Below is the complete list that was generated by the team.

Concerns Identified by the San Rafael response team:

1. Fire fighting operations (potential vector of spread)
2. Construction, oil & gas trucks (potential vector of spread)
3. Dust abatement (potential vector of spread)
4. Float tubes, small watercraft (potential vector of spread)
5. Law enforcement
6. Irrigation
7. Dam operations/ System operations
8. Monitoring protocol/ duration and intensity
9. Control and containment
10. Water rights and existing contracts
11. Fish and aquatic resources
12. Water Quality
13. Funding
14. Closure of waters
15. Availability of technical resources
16. Research
17. Power Plants
18. Communications
19. Culinary/secondary water systems

Many of the concerns can be grouped under more general categories. The eight categories below show how all the concerns generated by the team can be combined and will be addressed in this plan.

Combined categories:

1. Containment (fire fighting, construction water trucks, oil and gas water trucks, dust abatement water trucks, float tubes, small watercraft, closure of waters, involvement of law enforcement)

2. Affected systems & Resources, (irrigation, dam operation, culinary/secondary water systems, power plants, water quality, economy, fish and aquatic resources, water rights and existing contracts)

3. Control

4. Funding

5. Research

6. Monitoring Protocol

7. Communications

8. Availability of technical resources

A document created by Larry Dalton (Utah's AIS program coordinator) was created to act as a guideline for the development of a rapid response plan. The San Rafael rapid response plan will be created by following the guidelines set up in the fore mentioned document while incorporating the specific concerns identified by the response group.

The following protocols, which are objectives of the rapid response strategy, outline a reasonable response process; they were adapted in-part from Idaho's 2007 Aquatic Nuisance Species Plan and modified to suit Utah's needs and purposes.

Protocols for Rapid Response Strategy

• Immediately verify a reported AIS detection
• Upon verification for the presence of an AIS, immediately notify relevant local natural resource managers, pulling their technical personnel together as a "response team," and notify Utah's AIS Task Force
• The response team must immediately begin surveys to define the extent of an AIS infestation
• As the extent of infestation is being determined, set-up an appropriate command structure to guide continuing response team activities for determining and implementing containment and/or control methods for the AIS infestation
• Establish internal and external communication systems
• Organize available resources (personnel, equipment, funds, etc.), including compliance with laws and permitting requirements
• Prevent further spread using quarantine and pathway management
• Apply available, relevant and legally defendable eradication, control and/or containment actions and implement mitigation
• Institute long-term monitoring
• Evaluate response effectiveness, modify the Rapid Response Strategy as needed, and pursue long-term funding for AIS management

<u>Rapid Response Objective 1</u>: Immediately verify a reported AIS detection.

When AIS are suspected within the San Rafael drainage the first point of contact will be Daniel Keller of the Utah Division of Wildlife. The UDWR (Daniel Keller) in cooperation with the San Rafael response team will ensure that the three tasks descried below are accomplished in a timely manner.

Note: In regards to *Dreissena* mussels, this strategy is required by law (R657-60-4).

Task 1: Immediately interview the reporter(s), which may be anyone from the public, or a microscopy lab, and/or a lab that conducts deoxyribonucleic acid polymerase chain reaction tests (PCR) on plankton or tissue samples received from a Utah Aquatic Invasive Species Task Force partner agency, to begin validation of the alleged AIS detection.

• A microscopy report from a lab, based upon morphological or histological characters of a suspect specimen living in nature, is considered as preliminary for the presence of *Dreissena*. Such a report must only be provided to Utah Division of Wildlife Resources' AIS Coordinator.

• Following a microscopy report, Utah Division of Wildlife Resources' AIS Coordinator will request that the microscopy lab forward a portion of the original sample for two different and independent molecular deoxyribonucleic acid polymerase chain reaction tests (PCR) for confirmatory assessment regarding the presence of *Dreissena*. Again, reports for findings from PCR labs must only be provided to Utah Division of Wildlife Resources' AIS Coordinator.

Note: Security regarding any lab report results from a need to control release of the information, minimizing speculation by the media, public and others about environmental or economic impacts, and eventual containment and control methods prior to full assessment of the finding. Additionally, action by the Utah Wildlife Board is required in order to list any water in Rule R657-60-2(2)(g) as infested with a *Dreissena* species.

• Record details of the AIS find location, such as GPS delineation, name of the water body or stream length number, prominent landmarks, highway mile marker, or other information about where the suspect species was found.

• Collect pertinent contact information for the reporter(s)--name, address, telephone (home, work and cellular), and email.

• Secure an estimate of the number of individuals or colonies, density and extent (e.g. acreage or linear miles of stream) for infestation of the species found.

• Document the date and time of sighting(s).

• Note other relevant site conditions (access limitations, etc.)

Task 2: When Utah Division of Wildlife Resources' AIS Coordinator first receives notification from either a microscopy lab or a PCR lab regarding a *Dreissena* finding, the AIS Coordinator will immediately contact the Director's office at Utah Division of Wildlife Resources' and the Fishery Chief. This group will immediately meet to make a decision about release of the information to appropriate partners (water body operators and the Utah AIS Task Force). Any release of information by the AIS Coordinator to partner groups must consider need and value for a coordinated release of information to the media. And, media advisories will be orchestrated and coordinated amongst the water body operators and the Utah AIS Task Force by Utah Division of Wildlife Resources' Outreach Chief.

Task 3: Validate AIS identification as soon as possible via a physical sample as follows:

• Obtain a digital or other photograph (with scale indicator), if possible.

• Secure and preserve dead samples of the species, if possible, for confirmation.

• Arrange an immediate site visit, when feasible, by a team of recognized experts.
• If recognized experts cannot feasibly reach the site within 24 hours, arrange to ship samples and other evidence (e.g., photographs) via Express Mail Service. In the case of photographs, use a digital camera or scan (digitize) 35 mm or printed photos and email them to the experts.
Note: Prior to shipping samples, obtain guidance from recognized experts, seeking existing protocols regarding handling of the sample (e.g. desired quantity, where and how to collect and deliver the sample, preservatives, refrigeration, etc.).

<u>Rapid Response Objective 2</u>: Upon verification for the presence of an AIS, and with concurrence of Utah Division of Wildlife Resources' Director, immediately notify relevant natural resource managers (local natural resource managers, Utah's AIS Task Force, and AIS Coordinators in adjoining states), pulling appropriate technical personnel together as a "response team."

The UDWR (Daniel Keller) accepts responsibility for handling the initial report for the presence of an AIS within the San Rafael Drainage and upon verification for the presence of an AIS, UDWR will immediately ensure that all parties having local jurisdiction and interest in response decisions or having technical support capabilities are quickly engaged as a "response team". The San Rafael response team will act as the local experts to coordinate response activities.

Note[1]: The San Rafael response team is comprised of technical personnel from Utah Division of Wildlife Resources (AIS biologist); water body operator interests (local irrigation company's water master, water conservancy district and/or Bureau of Reclamation); local land management authority (private owners, Utah State Parks and Recreation, U.S Forest Service, and/or Bureau of Land Management).

Note[2]: In the case of an interdiction where rapid response by a professionally trained responder results in complete destruction of the AIS (e.g. apprehension for unlawful transport of a live AIS); and when possible, a successful decontamination of the introduction vector (e.g. boat or equipment) ensues, file pertinent reports notifying the response team and the Utah AIS Task Force. No further coordination is needed.

Note[3]: Routine day-to-day operations for interdictions of boaters at water bodies and resultant decontaminations do not require notification of the "response team," although summary reports for seasonal activity must be prepared, filed and shared with the team and Utah's AIS Task Force.

<u>Task 1</u>: Within the first 24 hours or as soon as practical after a physical sample is visually confirmed to be an AIS by a recognized expert, notify Utah Division of Wildlife Resources (Daniel Keller) (in the case of a *Dreissena* species this notification is required by Rule R657-60-4); notify and pull together the San Rafael response team; involve other relevant natural resource managers and interested publics to participate as determined by the team; advise Utah's AIS Task Force of the determination and planned future action.

Note: A local notification list will be maintained by Utah Division of Wildlife Resources (Daniel Keller) and be updated at least twice annually. Utah Division of Wildlife Resources' AIS coordinator in Salt Lake City will be notified about any AIS finds; he will immediately notify the Utah AIS Task Force.

Task 2: Within the first 24 hours or as soon as practical inform any other interested parties (e.g. elected officials; organized, local recreational user groups; media via the Outreach Section as determined necessary by Utah Division of Wildlife Resources Director; etc.).

Task 3: Make verification of notifications to confirm that parties on the contact list, did in fact, receive notification (e.g., use Internet list server response confirmation or phone call-backs).

Rapid Response Objective 3: The response team must immediately begin surveys to define the extent of an AIS infestation

The San Rafael response team will initiate a combined monitoring effort in 2009. The purpose of the surveys is to define the extent of the AIS infestation at Electric Lake and all other threatened water bodies within the drainage. Evidence indicates that the infestation of Electric Lake occurred quite recently or perhaps the population in the lake has been present for some time but is limited by environmental conditions (only microscopic veligers have been detected, no adults). Electric Lake is a very different system than other water bodies such as Lake Mead where mussel populations have exploded. Electric Lake water temperatures rarely reach the optimum level for growth and reproduction (15-17 C). Electric Lake is classified as oligotrophic to mesotrophic meaning that abundant food supply would not be available to support mussel populations. Furthermore, the fact that test results indicate it is zebra mussels, not quagga mussels, present in Electric Lake may prove beneficial for controlling mussel populations. Zebra mussels are not able to tolerate cold temperatures or colonize deep water to the extent that quagga mussels are capable of. However, it is important to note that ever since both zebra and quagga mussels invaded the U.S. they have shown an incredible ability to adapt to new environmental conditions. For this reason, we should assume that given enough time, the mussel population in Electric Lake will grow exponentially and cause economic and environmental damage.

Determining the extent of colonization of Dressinid mussels at Electric Lake will be given due precedence in our rapid response strategy to guide subsequent management decisions regarding containment and/or control. Daniel Keller of UDWR will act as monitoring coordinator for the San Rafael response team.

Starting in the spring of 2009 the San Rafael response team will begin surveys to determine the geographic extent and population demographics of zebra mussels in Electric Lake and possible populations in other watch waters (Joe's Valley, Huntington North) Upstream and downstream areas, connected water bodies, and nearby water bodies having potential vulnerability to spread will be surveyed. The

monitoring protocol for the San Rafael drainage is set up to be multilayered and all available resources will be pooled together to make a very concerted effort.

UDWR will ensure that surveys are completed as soon as possible and that results are reported to the entire response team, other interested parties, and the Utah AIS Task Force.

Monitoring Strategy

The monitoring process for each life stage is different. Adults are recognizable by their dark, zebra-like rays; very young zebra mussels, though barely visible, feel grainy to the touch. The veligers (planktonic larval stage) are visible only under a microscope. The process necessary to detect the planktonic larval (veliger) stage requires the most specialized procedures. Veligers must be collected using a 64 micron plankton net. A dissecting microscope with a crosspolarized light system is necessary to detect larval zebra mussels.

Since predicting which type of sampling will produce the first evidence of zebra mussels is impossible, a combination of plankton sampling, placement of substrate samplers (Figure 1) and regular examination of surfaces for settled adults will be used at Electric Lake and all other watch waters. These inspections will be made at least every two weeks, or more frequently at our watch waters or if we suspect water or equipment from a contaminated source may have entered the water body.

The following groups were given the assignment to develop a monitoring protocol that would be implemented in 2009.

1. State Parks managed water bodies within the San Rafael Drainage (Millsite, Huntington North, Scofield).
2. Irrigation companies
3. Bureau of Reclamation (BOR)
4. Emery County Water Conservation District (ECWD)
5. UDWR
6. Pacificorp
7. Castle Valley Special Service District (CVSSD)

Monitoring Protocol

1. **Monitoring protocol for State Parks managed water bodies within the San Rafael Drainage. Dan Richards is the state parks manager for Millsite, Scofield, and Huntington North Reservoirs. He will be the monitoring lead for those state parks.**

OBJECTIVE: Monitor Huntington North, Scofield and Millsite reservoirs for Quagga/Zebra mussel presence and submit a report as required.

STRATEGY:

1) Learn to identify mussels-this will require a mandatory in-house training program at all three parks for park staff including summer seasonals. All staff will be required to watch the training video "Don't Move A Mussel" and learn to identify Quagga/Zebra mussels.
2) The park will identify critical control points on the reservoirs and will inspect these sites once a week. These CCP's will include:
   - Docks.
   - State boats (moored during the summer on the water).
   - Concrete structures that are accessible.
   - Buoys.
   - As water recedes, shoreline areas, rocks, and other attachable structures will be checked for presence and absence.
3) Inspection form will be created for weekly monitoring.
4) Reports submitted as required.

2. Irrigation companies

The irrigation company's and conservation district will have the option to drain, treat, and or close for a season or more the waters they manage if a reservoir becomes infested with mussels (Cleavland, Miller Flat, Rolfson).

The UDWR will be taking a single plankton sample from Mammoth (Huntington) and will pay for the cost of processing and analyzing the sample. In the future, HCIC may wish to sample other locations; at such a time HCIC will set up a cooperative agreement with UDWR to collect the samples.

The irrigation companies do not wish to conduct any additional testing in their canals or regulating ponds at this time, however, this may change depending on the results of testing at Electric Lake, PacifiCorp's facilities, and the regional watch waters.

HCIC will work with the UDWR to educate their water masters, stockholders, and river commissioners about the significant impacts mussels could have on their irrigations systems. The UDWR will also train individuals who complete routine maintenance for the irrigation companies, training them how to identify and search for mussels in likely locations for colonization.

With the extensive monitoring efforts that are planned at Electric Lake, Huntington North, Joe's Valley, and Pacificorp the HCIC does not see the benefit of sampling smaller regulatory ponds at this time. The bulk of the irrigation companies' infrastructure is below the power plant. Thus, monitoring at the power plant can serve the purpose of indicating how at risk the lower drainage is to the spread of mussels. If veligers are detected at PacifiCorp's monitoring sites, HCIC will initiate a more comprehensive sampling protocol where regulating ponds such as Jethro Pond,

Snowball, and Lawrence South Ponds would be assessed for the presence of veligers and adult mussels.

3. **BOR**
   Currently the BOR is working on providing funds that would assist in the efforts to monitor BOR waters within the San Rafael drainage.

4. **EWCD**
   Emery Water Conservation District has expressed ability to help with sampling costs at Joe's Valley and Huntington North. A cooperative agreement will be written to reach an agreement on the dollar amount of funding available and how it will be used. EWCD is also working on creating an informational alert on their webpage making the public aware of the infestation at Electric Lake and how they can help prevent the spread of AIS.

5. **UDWR**

Plankton Sampling Protocols

a. Infested waters will be sampled every two weeks.
b. Watch waters will be sampled every two weeks.
c. All other waters that were sampled in 2008, with the addition of Recapture Reservoir (not within San Rafael drainage) will be sampled one time in 2009.

Specific sampling protocol for Electric Lake and watch waters are still being developed (number of sample sites, volume of water to filter, etc.)

The number of waters sampled in 2009 can be increased if alternate funding sources are made available to the UDWR. Agencies or companies that are interested in monitoring water bodies to protect their interests may set up a MOU with the UDWR to schedule additional sampling efforts (examples: sampling PacifiCorp's cooling reservoirs or HCIC's Clevland Reservoir)

Note1 :
1. Preserve with 25% ethanol (be prepared to up the preservation to 70%) if instructed;
2. Keep ½ of alloquat at region
3. Infested waters—send ½ of alloquat to Pisces Molecular for PCR;
4. Watch waters—send ½ of alloquat to BOR microcospy lab (positive finds will be farwared to Pisces for PCR);
5. All Other waters—send ½ of alloquat to BOR microcospy lab (positive finds will be forwared to Pisces for PCR);

Note2: Peak spawn occurs between 15-17 degrees Celsius and waters will not be sampled until temperatures reach 15 degrees.

6. **Pacificorp**

UDWR responsibilities:
- Sample collection at Electric Lake (frequency and location protocol to be determined by UDWR)
- Obtain lab analysis for all samples from Electric Lake and the plant holding ponds - All results to be shared with PacifiCorp
- If manpower resources allow, UDWR will also collect samples from plant holding ponds

PacifiCorp responsibilities:
- Provide 1 person to assist UDWR in collecting water samples from Electric Lake
- Conduct visual inspections for adult mussels at : Electric Lake discharge structure, EL spillway, EL boat ramp, Huntington Plant diversion on Huntington Creek, Huntington Plant pond
- Reimburse UDWR for analytical costs for all samples taken from plant holding ponds
- Reimburse UDWR for sample collection costs for all samples DWR takes from plant holding ponds
- If UDWR can not provide the manpower to collect plant holding pond samples, PacifiCorp will collect the sample with their equipment and labor
- Purchase 7-10 continuous temperature probes, install at strategic locations throughout the drainage and collect temperature data throughout the year. Temp. data to be shared with UDWR
- Purchase substrate samplers, install at strategic locations throughout the drainage and monitor throughout the year. Monitoring information to be shared with UDWR

7. CVSSD

In time CVSSD may elect to conduct sampling at their secondary water ponds. Ponds that have been identified as potential monitoring sites are Elmo, Clevland, and Huntington.

<u>Rapid Response Objective 4</u>: As the extent of infestation is being determined, set-up an appropriate command structure to guide continuing response team activities for determining and implementing containment and/or control methods for the AIS infestation.

As the extent of AIS infestation is investigated, supervisory leadership for the response team members will immediately meet, to make assignment amongst their staffs for a continuing response and commitments for other needed resources.

The Incident Command System (ICS) is a management protocol originally designed for emergency management agencies and later federalized. ICS is based upon a flexible, scalable response organization providing a common framework within which people can work together effectively. These people may be drawn from multiple agencies that do not routinely work together, and ICS is designed to give standard response and operation procedures to reduce the problems and potential for miscommunication on such incidents.

Efforts to contain and/or control AIS within the San Rafael Drainage will follow the framework of ICS to facilitate command and decision-making processes. Concurrence amongst the supervision for the response team members must be achieved about how to proceed in order to expedite conduct of work, avoid duplication of effort, facilitate public outreach and information sharing between agencies, minimize authority conflicts, while preserving flexibility for adaptive management.

> **Note[1]:** On January 27, 2009 the San Rafael response team agreed that Daniel Keller of the UDWR will act as incident commander. This appointment is in regards to the finding of zebra mussels at Electric Lake. In the event of a future discovery of AIS the San Rafael Response team will again meet and decide to either keep the command structure the same or appoint a new incident commander.
>
> **Note[2]:** Where multiple agencies have shared jurisdiction over a water body (e.g. Bureau of Reclamation water management operations and U.S. Forest Service recreational and land management operations), a unified command structure with co-lead incident commanders may be used.
>
> **Note[3]:** Likely an incident commander will originate from a state or federal natural resource management agency having jurisdiction over the infested water and surrounding recreation area. An incident commander should currently hold a leadership position allowing for the necessary time commitment and experience to lead a multi-agency response team.
>
> **Note[4]:** The incident commander will be the voice to represent the response team, and will direct and coordinate development and implementation of a rapid response to contain and/or control an AIS infestation.
>
> **Note[5]:** In the event there is no initial consensus on the incident command role, this role will default to the UDWR statewide AIS Coordinator and/or the appropriate U.S. Fish and Wildlife Service Regional AIS Coordinator until the relevant water body/recreation area operation authorities achieve concurrence on incident command.

Key concepts listed below were taken from ICS and will be applied to the command structure of the San Rafael Response Group.

- Each individual participating in the San Rafael response team will report to only one supervisor (incident commander) this eliminates the potential for individuals to receive conflicting orders from a variety of supervisors, thus increasing accountability, improving the flow of information, and helping with the coordination of response efforts.
- The San Rafael response team will be based on a "first-on-scene" structure, where the first responder of a scene has charge of the scene until the incident has been declared resolved, or the incident commander arrives and assumes control.

- When different organizations are required to work together, the use of common terminology is an essential element in team cohesion and communications, both internally and with other organizations responding to the incident. The glossary of terms (Appendix D under development) will help bring consistency to position titles, the description of biological terms, and a host of other subjects.

Rapid Response Objective 5: Establish internal and external communication systems.

Strategy: In the event of new AIS findings within the San Rafael Drainage the Incident Commander and the response team will develop an information dissemination process to ensure consistent and effective communication to interested internal and external stakeholders, including the media and public.

Task 1: Notify and educate affected landowners, and where appropriate, gain their written permission to access property for response team activities.

Task 2: Notify and educate potentially affected water users and water-rights holders.

Task 3: Develop a public information strategy, press packets, press release processes, and press conferences.

Task 4: Develop and implement general public education and outreach.

The San Rafael response team identified a need to install signs at Electric Lake making the public aware that it is an infested water body and their responsibilities as a boater to decontaminate.

Utah Association of Conservation Districts currently has a pending grant that would cover the cost of three informational signs. PacifiCorp also agreed to cover the installation match portion of this grant.

Having other waters bodies currently listed as infested (Red Fleet) makes it necessary to coordinate with other regions to create a sign that will be used state wide in order to prevent sending mixed messages to the public. The UDWR will work with UACD and PacifiCorp to create and install these signs in 2009.

Note[1]: Regarding tasks 3 & 4, assistance from a professional outreach staff member from one of the response team agency's should be sought, since they have expertise and previously established liaison with local and statewide media resources and personalities.

Rapid Response Objective 6: Organize available resources (personnel, equipment, funds, etc.), including compliance with laws and permitting requirements.

Strategy: The Incident Commander and the response team must identify and secure sufficient resources to affect AIS eradication, control and/or containment actions, including recognition for need to comply with a broad array of local, state and federal laws and permitting processes.

Task 1: Develop estimates and identify potential sources for the response team's needs regarding staff, facilities, equipment and funds.

Task 2: Secure commitment from the response team's home agencies and others for needed staff, facilities, equipment and funds.
Protecting our waters from AIS is a large undertaking that will require a combined effort from all water users. Many agencies and companies have already devoted time and resources to this plan. Acting as the lead agency, UDWR would greatly benefit from any additional funds or resources that could be allocated towards aquatic invasive species management. Many agencies have made resources available for invasive species management in the San Rafael drainage and currently agreements are being developed to utilize funds from outside agencies.
Task 3: Ensure mechanism for dispersal of funds is in place, and when the funds are needed, that the flow of dollars occurs expeditiously, including inventory control for acquired equipment.
Task 4: Arrange for the response team to be briefed about the array of local, state and federal laws that pertain to the activities in which they may engage to achieve AIS eradication, control and/or containment (e.g. National Environmental Policy Act considerations regarding need for environmental statements, assessments and prior approved actions recognized as categorical exclusions, including need for associated mitigation; Endangered Species Act consultations and compliance; etc.).
Task 5: Arrange for the response team to be briefed about the array of local, state and federal permits that may be needed to conduct the activities in which they may engage to achieve AIS eradication, control and/or containment (e.g. pesticide applicator permit; National Pollutant Discharge Elimination System permits administered by the Environmental Protection Agency and the Utah Department of Environmental Quality; etc.).
• Consider any applicable emergency provisions associated with permits (e.g. Federal Insecticide, Fungicide and Rodenticide Act, Federal Crisis Exemption--40 C.F.R. PART 166--can be secured if the known or accepted methods of eradication are not currently permitted);
• Keep in mind that state and national permits under some programs already exist (e.g. state stream alteration permits administered by Utah Division of Water Rights, section 404 Clean Water Act dredge and fill permits administered by the Army Corps of Engineers; etc.) and
• Assess modifying existing agency permits for needed purposes as opposed to securing a new permit
Task 6: If reasonable and necessary, pursue declarations of emergency by elected officials.

Rapid Response Objective 7: Prevent Further Spread Using Quarantine and Pathway Management.

Strategy: The Incident Commander and the response team in coordination with agencies having regulatory authority must minimize all vectors and pathways that might further spread the original infestation.

Task 1: Evaluate risks for dispersal vectors and pathways for further spreading the AIS, including movement by human activity, construction, water-haul and recreational equipment, movement by fish and wildlife, movement via water flow, and other physical processes.

Likely vectors of further spread

Float tubes, canoes, and other small water that jump to water bodies all over the region have been identified as a major vector for further spread. For this reason, increased efforts will be made to target and educate small water craft users as well as traditional boaters. One method that will be encouraged for cleaning float tubes is to use 409 cleaner which can be purchased at most grocery stores. The active chemical in 409 cleaner is quaternary ammonium compounds, which have been shown to be 100 percent effective in killing AIS such as whirling disease and New Zealand mud snails. Spraying a float tube down with 409 cleaner or a diluted bleach solution would be an effective way for individuals to decontaminate their tubes (0.6 liquid oz Clorox per gallon water). These measures are precautionary and are not a replacement for following the drying recommendations outlined in the self decontamination protocol. Individuals that launch watercraft on a mussel infested water body must either fully self decontaminate or have a professional decontamination. Efforts will be made to have a technician and a decontamination unit available at Electric Lake to wash departing boats during times of peak activity. When resources are not available for a professional decontamination, boaters are required to comply with the self decontamination procedures or contact the UDWR to schedule a hot power wash before they launch their watercraft at another water body.

Water tucks associated with the oil and gas industry or those used in fire fighting operations have been identified as a potential vector of spread. Government agencies are encouraged to take note of the protocol established for disinfecting equipment such as helicopter draft buckets or water tanks that have came in contact with raw water. Appendix E is a document implemented by the U.S. Forest Service that is to be used as a guide for cleaning water hauling equipment to prevent the spread of invasive species. This protocol would also be appropriate for disinfecting other vectors identified by the group such as dust abatement trucks, which often draft from various water sources. The San Rafael response groups will monitor our partners to ensure that this protocol is implemented when applicable.

The natural flow of water from Electric Lake to Huntington North may eventually lead to the infestation of Huntington North reservoir. However, at this time it is unknown if veligers will survive the journey to Huntington North. Increased monitoring this summer (2009) will help answer that question. The value of Huntington North as a water source for HCIC's irrigation system and as a popular State Park makes this reservoir a prime location for mussels to cause economic damage. Listed as a "watch water", increased efforts will be made to detect

mussels in the early stages of infestation giving the response team time to evaluate treatment and containment options.

Due to the close proximity to local communities and the warm water Huntington North is a more popular recreation destination compared to Electric Lake. If Huntington North eventually becomes infested washing every departing boat for containment purposes will be a large undertaking. Efforts are currently being made to increase our decontamination equipment and capabilities to move towards containment as needed in the future.

Task 2: Restrict dispersal vectors and pathways, where feasible, including the following or similar measures that are suitable for individual species:
• Under authority of Rule R657-60-8, consider closure of infested water bodies, facilities, or water supplies, as needed, to prevent spread of *Dreissenid* mussels by human activity, construction, water-haul and recreational equipment, movement by fish and wildlife, movement via water flow, and other physical processes;

Many scenarios were discussed in regards to the closure of Electric Lake to Boating. Rule R657-60-8 makes it mandatory for boaters departing Electric Lake to either self decontaminate or have a professional decontamination. Some have suggested that closing the water would be the sure way to minimize the threat of spread to other water bodies. However, impacts to the boating community and economy need to be addressed. Closing a water body also sets precedence for our actions in the future and we need to be consistent with our management practices. One alternative to completely closing the lake to boating is to use a controlled access system. Boating on the lake could take place during set hours when a technician and a decontamination unit would be available to clean departing boats. A gate would need to be installed to prevent boats from launching at unauthorized times and law enforcement entities would need to be available to enforce this closure. If a controlled access strategy is chosen the UDWR would need partners to help fund technicians. Educating boaters and decontaminating boats has been shown to be effective in preventing the spread of mussels in other states (Minnesota). For this reason, the best alternative may be to continue focusing our efforts on educating/decontaminating boaters.

Enforcement of the self certification process will be critical in preventing the spread of mussels. Prior to launching, boaters are required to fill out and sign a self certification document verifying that they have not been in an infested water body in the last 30 days. If they have been on a infested water and have not self decontaminated the UDWR will provide a professional hot water decontamination free of charge. After signing, boaters place this document on the dash board of their vehicle so personnel can check compliance. If boaters fail to complete a self certification they are in violation of state rule and could receive a fine. Last year, with the exception of Lake Powell, no fines were issued even though compliance with the self certification was very low in some cases. Last year much of the focus was on educating boaters about their responsibility to self certify thus avoiding

punishing boaters that were unaware of the new regulations. This next boating season, increased efforts need to be made to ticket non compliant boaters, as word spreads among the boating community and boaters realize they can receive a fine, compliance should drastically improve.

• Assess the likely movement patterns of boats that recently used the infested water body to identify risk and inspection needs at other water bodies;
• Establish inspection requirements and decontamination protocols for boats and equipment, and provide decontamination opportunity;
• Ensure that AIS "alert" signs are adequately deployed;
• Develop and implement Hazard Analysis and Critical Control Point plans to ensure that private and local, state, tribal or federal government response personnel do not further spread the original infestation;
• If possible, stop or slow water releases to potentially non-infested sites;
Note: Consider making water draws from below the thermocline; and
• Install physical barriers, if possible, to affect AIS movement (e.g. migration barriers to fish populations that harbor whirling disease, keeping them out of non-infested areas).

Rapid Response Objective 8: Apply available, relevant and legally defendable eradication, control and/or containment actions and implement mitigation.

Strategy: The Incident Commander and the response team must evaluate management options for eradication, control and/or containment of the AIS, and then proceed, including implementation of suitable mitigation.

Task 1: Decide whether eradication, control and/or containment is possible based on rapid analysis of population dynamics, extent of distribution and analysis of vectors and pathways for AIS spread and available management options. Consider the following:
• Anticipated cost of eradication effort and follow-up monitoring relative to available funding;

The cost of treating water bodies with Kcl has been estimated using information from small scale Kcl treatments and the current price of the product.

Huntington North Example (Kcl):
Jay Humphrey from EWCD indicated that they could bring Huntington North Reservoir down to about 1500 to 1600 Acre Feet. This is the amount of water left in dead pool without pumping water out.

Calculations using a rate of 100mg/liter of water and a cost of .44/pound (Kcl):
1 Acre Feet = 1,233,000 liters
1,233,000 liters * 100 mg = 123,300,000 mg/ Acre feet
123,300,000 mg = 271.829 pounds
271.829 pounds * 1500 = 407743.5 pounds
407743.5 * .44 = $179,407

Or $119.6 per Acre Foot

$ 179,407 is the price for the Kcl alone and does not include the large effort that would be needed to get the salt into the water and monitor its effects.

Treatment with traditional fisheries chemicals.

RotenoneTM (15 mg/L for 24 hours) or chelated copper (2 mg/L for 48 hours) have been shown to kill zebra mussels when applied for other control purposes in infested ponds. These compounds are not, however, labeled specifically for zebra mussel control in aquaculture settings.

Huntington North Example (Rotenone treatment cost estimate, 15 mg/liter, $2.17/pound)
1 Acre Feet = 1,233,000 liters
1,233,000 liters * 15 mg = 18,495,000 mg/ Acre feet
18,495,000 mg = 40.77 pounds
40.77 pounds * 1500 = 61,155 pounds
61,155 pounds * $2.17= $132,706

$132,706 for the product or $88.4 per Acre Foot

This method kills everything in the water as opposed to Kcl which only kills mussels.

Chemical treatment options

There are four chemicals that have been identified as 100% effective in killing zebra and quagga mussels. Drawing down the water to dead storage will decrease that amount of chemical needed to treat the water. Also, drawing down the water in the late fall when night time temperatures approach freezing will effectively kill any mussels around the lake that do not make their way back into water.

Chemical	Application	Effect
Potassium Phosphate (KH2PO4)	160-640ppm (continuous)	100% kill
Potassium Hydroxide (KOH)	>10ppm	100% veliger kill
Potassium Chloride (Kcl)	50ppm (48 hours)	100% kill
Copper ions	5ppm (24 hours)	100% kill

Formula

Volume of water to be treated * PPM * Correction factor / strength of the chemical = weight of the chemical

Correction factor if using grams / gallon is 0.00378

Potassium Chloride is preferred to other treatments because the other available chemicals can harm fish. Potassium Chloride has been used in a zebra mussel eradication in the Millbrook Quarry, Virginia. 100 ppm Potassium Chloride was maintained for 48 hours this concentration and duration killed 100% of the mussels in the quarry but did not harm the bass and bluegill which are present in the quarry.

Water management as a control

Zebra mussels can be eliminated from a reservoir by draining and drying it for an extended period, preferably during the winter or late fall when the remaining mussels would freeze. Because zebra mussels are usually restricted to shallow, near shore areas above the thermocline, lowering water levels can expose the majority of the population, thereby greatly reducing the number of adults and veligers. Reducing the density of settling veligers in intake water would in turn reduce the settlement rate within the systems, and increase the interval required between applications of mitigation measures.

Some reservoirs within the drainage have been identified as waters where a complete drain (or very near complete drain) could be accomplished. For example, the outlet structure at Clevland Reservoir is set up in a way that nearly all of the water could be drained in the late fall after the demand for irrigation water is over. Under this scenario if night time temperature would reach freezing for three consecutive days all exposed mussels would be killed. Pending a good snow pack during that winter, the reservoir could then be filled to some extent minimizing impacts to the irrigation companies. Also, reservoirs such as Miller Flat and Rolfson could be utilized more in subsequent years to allow Clevland to once again return to full pool. An alternating schedule of draining and refilling these smaller reservoirs could be a cost effective control strategy in the event they become infested.

Another water management tactic that has been identified by the response team is to conduct water releases below the thermocline at Electric Lake. During the summer at Electric Lake a thermocline develops from approximately 6 to 11 meters (Figure 2). Adult mussels will prefer to colonize the warmer water above the thermocline. Therefore, pulling frigid water from the hypoliminon where mussels will not be heavily infested would minimize the probability of veligers and adults being pulled into the infrastructure of the dam and being sent down stream. The drawback to hypoliminon releases is that the very cold water moving down stream could negatively impact the aquatic system of Huntington Creek.

Biological Controls

Controlling zebra mussels with mussel-eating fish is not effective. Several species, such as sheep's head, blue catfish and common carp, eat zebra mussels but don't significantly affect mussel populations. Some aqua-culturists have considered importing exotic fish, such as the Chinese black carp, to eat zebra mussels. These exotics are unlikely to provide mussel control. Europeans tried to

control mussels in culture ponds with black carp in the 1960s, but they were unsuccessful.

Due to the lack of evidence on the effectiveness of mussels eating fish as biological controls they will not be considered as viable control options for this plan.

Researches Dan Molloy and Pam Marrone are currently conducting research on a strain of bacteria that has shown promise as a biological control of zebra mussels. Below is a summary of their research and the details concerning future availability of the product. Although this method is not immediately available for use the response team will keep up to date on the ongoing research in order to decide if this product could one day be utilized as a biological control within the San Rafael Drainage.

In 1991, the Empire State Electric Energy Research Corporation (ESEERCO) contracted with the New York State Museum (NYSM) Field Research Laboratory to screen bacteria as potential biological control agents for zebra mussels. After screening trials on more than 700 bacterial strains, only a North American isolate, strain CL145A of *Pseudomonas fluorescens*, was identified as able to produce >90% zebra mussel kill. When a zebra or quagga mussel ingests artificially high densities of strain CL145A, toxin within the bacterial cells destroy the mussel's digestive system. Dead cells are equally as lethal as live cells, indicating that the mussels die from a natural compound, not from infection. The bacteria are more effective in higher temperatures and in harder water, and they kill all mussel sizes and stages. Techniques have been developed at the NYSM laboratory that kill the bacteria without reducing their lethality to the mussels. Patents have been issued in both the US and Canada, and commercial products developed by Marrone Organic Innovations (MOI), based on this microorganism will contain dead cells, further reducing environmental concerns. Molloy and Marrone hope to begin testing the bacteria in the either Hoover Dam or Davis Dam hydroelectric dam pipes this year, as the next step toward developing a product that could be used commercially by power plants and water treatment facilities as soon as late 2009 or early 2010. But there are still several hurdles before testing could begin, including EPA permitting. The bacteria would likely require an EPA experimental use permit, and Marrone will test different formulas, including pellets, liquids and powders.

Preferred reference for zebra mussel control

Many other methods such as applying mussel repelling surface coatings, installing sand filters or chlorination systems can be used to control or exclude *Dreissena* mussels from water systems. The purpose of this plan was not to go into a through discussion of all of these control methods. In fact, this work has already been completed. One of the most comprehensive and well written compilations on

zebra mussel impacts and controls was written by Charles R. O'neill. His book titled The Zebra Mussel, includes detailed discussions of all available control techniques including the pros and cons of various methods, and references to research validating the methods.

The San Rafael Response team has selected this publication to act as our guide in selecting and implementing control strategies in the future.

Copies of this publication may be purchased from the following contact:

Cornell University, Media Services Resource Center, 7 Cornell Business and Technology Park, Ithaca, NY 14850.

Phone: 607-225-2080
Fax: 607-255-9946
Email- Dist_Center@cce.cornell.edu

UDWR also has some copies available.

Task 2: Obtain relevant permits and regulatory agency support or concurrence for planned actions facilitating AIS eradication, control and/or containment methods, including agreed upon mitigation.
• Identify the lead contact within each regulatory agency who will facilitate permit approval, staying in touch until the permit or letter of authorization is issued.
Task 3: Implement appropriate eradication, control and/or containment methods using adaptive management approaches as appropriate.
Task 4: Consider funding research and development efforts to find new eradication, control and/or containment methods.
Task 5: Implement agreed upon mitigation.

Rapid Response Objective 9: Institute Long-Term Monitoring.

Strategy: The Incident Commander and the San Rafael response team must collect and document data from long-term monitoring of the AIS infestation, including the post treatment period.

Task 1: Design and conduct a project-specific and long-term monitoring program to evaluate the status of the AIS infestation. Include the post treatment period as it relates to effectiveness of treatment or non-treatment.
Note: Every monitoring project will be uniquely different in terms of AIS, location and sampling periodicity, although methodologies for biological monitoring of aquatic populations and aquatic habitats are relatively standardized.
• Monitoring of the AIS infestation can be carried out in coordination with other field operations, such as monitoring to meet permit or other regulatory compliance resulting from eradication, control and/or containment actions or monitoring for mitigation effectiveness.

Task 2: Disseminate findings through an easily accessible, consolidated, coordinated real-time database and list serve (e.g. 100th Meridian Initiative's website).

Rapid Response Objective 10: Evaluate response effectiveness, modify the Rapid Response Strategy as needed, and pursue long-term funding for AIS management.

Strategy: The Incident Commander and the San Rafael response team, in order to allow for adaptive management by assuring feedback on the efficacy of response actions and the effectiveness of the San Rafael Rapid Response Strategy, can enhance long-term preparedness for responses to other AIS introductions.

Task 1: Conduct a follow-up evaluation by response team organizations and other interest groups to identify opportunities for improving the Rapid Response Strategy. Disseminate "lessons learned" to other interested organizations (e.g. states, national Aquatic Nuisance Species Task Force, 100th Meridian Initiative, Regional Panels and River Basin teams).

Task 2: Revise the Rapid Response Strategy and associated documents/guidelines based on evaluation and long-term monitoring results.

Task 3: As resources allow, develop and implement an assessment that evaluates the associated ecological and economic impacts of the AIS invasion, the effectiveness of management interventions, and negative consequences of management interventions beyond that required by permits.

Task 4: Determine the need for long-term funding for the current AIS management effort, and seek this funding as warranted by meeting with state and federal legislators.

Conclusion:

This plan will not answer all the complicated problems we face in a future intertwined with aquatic invasive species. However, the efforts of the San Rafael Response Team have accomplished many things. Some of the accomplishments include increasing the awareness of water users so they can better prepare for any future impacts. Also, this plan will result in the unification of resources to better protect our valuable ecological, industrial, and irrigation systems.

This plan set up a communication structure that will aid in the efficient dissemination of information and provided a protocol for verifying the presence of AIS. We were also able to combine our monitoring efforts which will allow us to cover more area and share information with water users throughout the drainage.

This document is a "living document" that will be updated and added to on a regular basis as technologies, contacts, or the status of AIS within the drainage change.

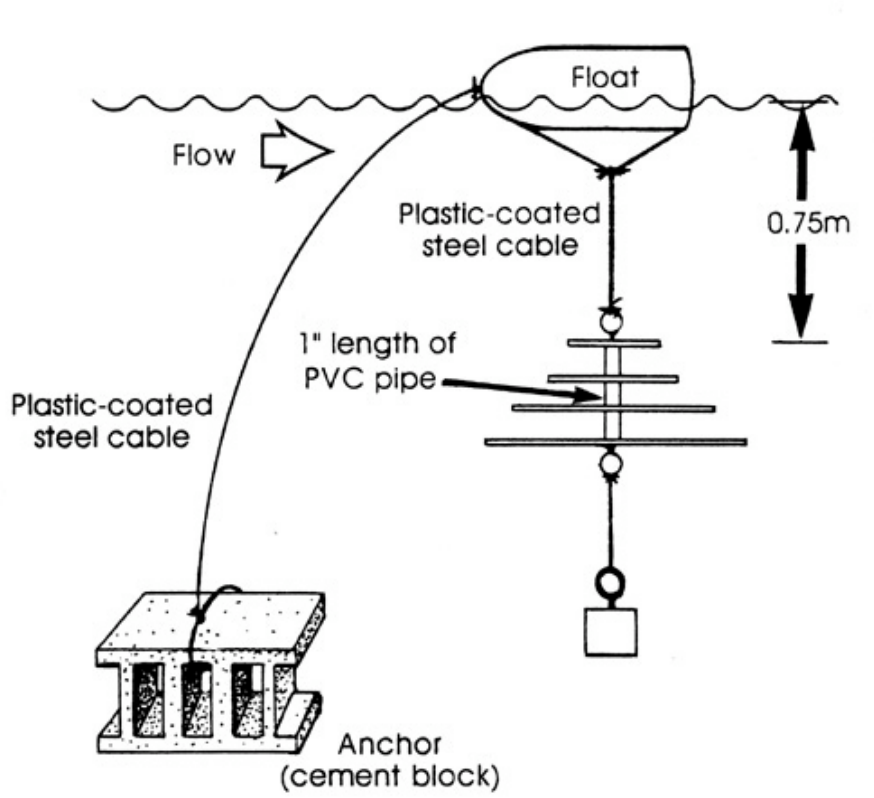
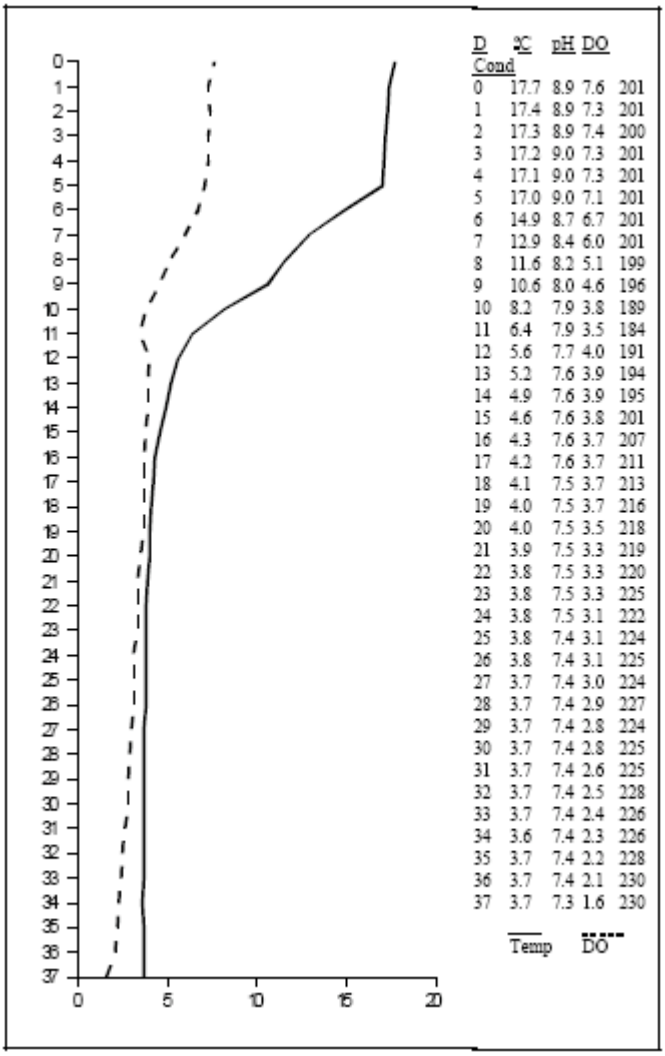


Figure 1. Example of a zebra mussel substrate sampler.
Available for purchase at:
http://www.wildco.com/vw_prdct_mdl.asp?prdct_mdl_cd=150%2DD10



D	°C	pH	DO	Cond
0	17.7	8.9	7.6	201
1	17.4	8.9	7.3	201
2	17.3	8.9	7.4	200
3	17.2	9.0	7.3	201
4	17.1	9.0	7.3	201
5	17.0	9.0	7.1	201
6	14.9	8.7	6.7	201
7	12.9	8.4	6.0	201
8	11.6	8.2	5.1	199
9	10.6	8.0	4.6	196
10	8.2	7.9	3.8	189
11	6.4	7.9	3.5	184
12	5.6	7.7	4.0	191
13	5.2	7.6	3.9	194
14	4.9	7.6	3.9	195
15	4.6	7.6	3.8	201
16	4.3	7.6	3.7	207
17	4.2	7.6	3.7	211
18	4.1	7.5	3.7	213
19	4.0	7.5	3.7	216
20	4.0	7.5	3.5	218
21	3.9	7.5	3.3	219
22	3.8	7.5	3.3	220
23	3.8	7.5	3.3	225
24	3.8	7.5	3.1	222
25	3.8	7.4	3.1	224
26	3.8	7.4	3.1	225
27	3.7	7.4	3.0	224
28	3.7	7.4	2.9	227
29	3.7	7.4	2.8	224
30	3.7	7.4	2.8	225
31	3.7	7.4	2.6	225
32	3.7	7.4	2.5	228
33	3.7	7.4	2.4	226
34	3.6	7.4	2.3	226
35	3.7	7.4	2.2	228
36	3.7	7.4	2.1	230
37	3.7	7.3	1.6	230

Temp DO

Figure 2. Temperature/DO/PH profile for Electric Lake (Data collected August, 29 1991)

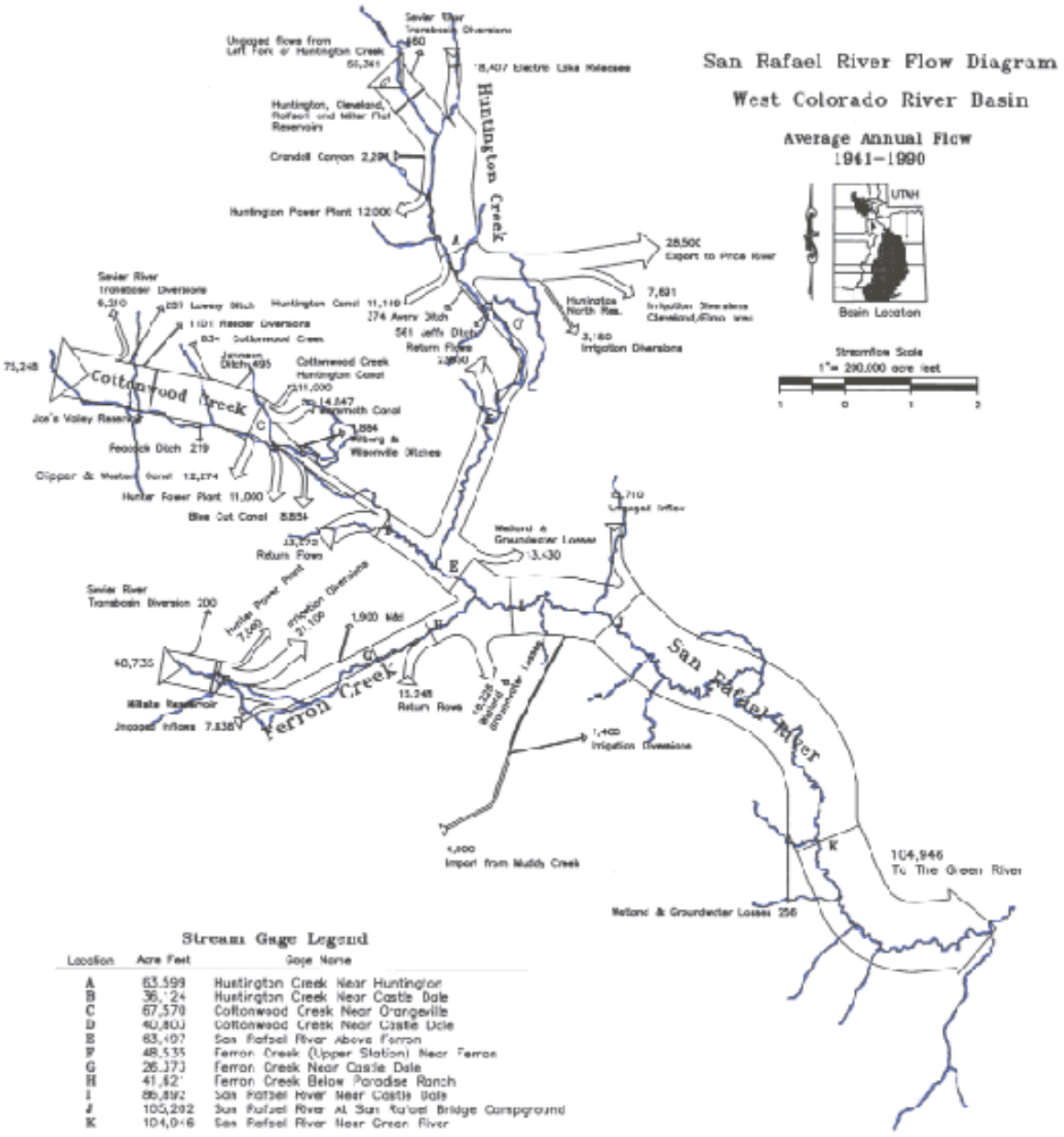


Figure 3. Map of the San Rafael Drainage.

Appendix A.

Results of Dreissenid mussels sampling in the State of Utah (2008)			
Water	Status	Mussels found	Region
Bear Lake	not detected	none	Northern
Big Sandwash Reservoir	not detected	none	Northeastern
Bottle Hollow Reservoir (Ute Tribe)	not detected	none	Northeastern
Calder Reservoir	not tested	unknown	Northeastern
Colorado River (Moab)	not detected	none	Southeastern
Crouse Reservoir	not tested	unknown	Northeastern
Cutler Reservoir	not tested	unknown	Northern
Deer Creek	not detected	none	Central
East Canyon Reservoir	not tested	unknown	Northern
Echo Reservoir	not tested	unknown	Northern
Electric Lake	infested	Zebra	Southeastern
Fish Lake	not detected	none	Southern
Flaming Gorge	not detected	none	Northeastern
Green River (Ouray bridge)	not detected	none	Northeastern
Gunlock Reservoir	not tested	unknown	Southern
Huntington North Reservoir	inconclusive	more testing required	Southeastern
Hyrum Reservoir	not tested	unknown	Northern
Joes's Valley Reservoir	inconclusive	more testing required	Southeastern
Jordanelle Reservoir	not detected	none	Central
Koosherm	not detected	none	Southern
Lake Powell	inconclusive	more testing required	Southern
Mammoth Reservoir	not detected	none	Southeastern
Mantua Reservoir	not tested	unknown	Northern
Matt Warner Reservoir	not detected	none	Northeastern
Midview Reservoir (Ute Tribe)	inconclusive	more testing required	Northeastern
Millsite Reservoir	not detected	none	Southeastern
Minersville Reservoir	not tested	unknown	Southern
Newton Reservoir	not tested	unknown	Northern
Otter Creek Reservoir	not detected	none	Southern
Panguitch Lake	not detected	none	Southern
Pelican Lake	inconclusive	more testing required	Northeastern
Piute Reservoir	not detected	none	Southern
Pineview Reservoir	not detected	none	Northern
Quail Creek Reservoir	not detected	none	Southern
Recapture Reservoir	not tested	unknown	Southeastern
Red Fleet Reservoir Substrate	infested	Quagga	Northeastern
Rockport Reservoir	not tested	unknown	Northern
Sand Hollow Reservoir	not detected	none	Southern
Scofield Reservoir	not detected	none	Southeastern
Starvation Reservoir	not detected	none	Northeastern
Steinaker Reservoir	not detected	none	Northeastern
Strawberry Reservoir	not detected	none	Central
Utah Lake	not detected	none	Central
Willard Bay	not detected	none	Northern
Yuba Reservoir	not detected	none	Central

Appendix B. Participants Invited

Utah Division of Wildlife Resources:
Paul Birdsy
Justin Hart
Bill Bates
Lt. Carl Gramlich
Larry Dalton
Walt Donaldson
Clay Perschon
Dan Keller

Utah Anglers Association:
Brock Richardson

Utah Division of Water Resources:
Mike Suflita

Utah State Parks & Recreation:
Dave Harris
Dan Richards

Utah Department of Agriculture and Food:
Kent Hauck

U.S. Fish & Wildlife Service:
Erin Williams
Kevin McAbee

National Park Service:
Melissa Trammell

U.S. Forest Service:
Cynthia Tait
Pam Jewkes
Mat Meccariello
Nicole Nielson
Kevin Albrecht
John Healy

San Rafael Conservation District:
Daniel Gunnel

Bureau of Land Management:
Justin Jimenez
David Waller

Central Utah Water Conservancy District:
Reed Orbendorpher

Washington County Water Conservancy District:
Corey Cram
Michelle Gregory

Bureau of Reclamation:
Russ Findlay

Utah Reclamation Mitigation Conservation Commission:
Maureen Wilson

Ute Tribe:
Jay Groves

Emery County Public Lands:
Ray Petersen

Pacificorp (Rocky Mtn. Power):
Kyle Singleton
Darce Guymon
Cody Allred
Richard Nielson

Emery County Progress:
Josie Luke
Patsy Stoddard

Price River Water Improvement District:
Jeff Richens

Huntington Clevland Irrigation Company:
Sherrel Ward

Cottonwood Creek Irrigation Company:
Craig Johansen President

Ferron Canal & Reservoir Company:
Tracy Behling

Emery Water Conservancy District:
Jay Mark Humphrey
Bruce Wilson

Huntington Creek River Commissioner:
Brett Leamaster

Castle Valley Special Service District:
Darrel Leamaster

North Emery Water Uses Association:
Jack Stoyanoff

NRCS:
Wayne Greenhalgh

Emery County:
James Nielson
Gary Kofforel
Morris Sorensen

Emery County Commissioner:
Laurie Pitchforth

Carbon County:
Gary Sonntag

NACD:
Rodger Barton
Jeana Wells

Castle Country Bass Masters:
Dave Babcock

Local Angler:
Tom Ogden

Appendix C. Individuals attending the Jan/14/2009 meeting

Utah Division of Wildlife Resources:
Justin Hart
Bill Bates
Larry Dalton
Clay Perschon
Dan Keller
Natalie Muth
Garn Birchell

Utah State Parks & Recreation:
Dave Harris
Dan Richards
Wayne Monroe
Tim Smith

USDA:
Jim Spencer
Shane Green
Wayne Greenhalgh

U.S. Forest Service:
Pam Jewkes
Nicole Nielson

San Rafael Conservation District:
Daniel Gunnel

Bureau of Land Management:
David Waller

Bureau of Reclamation:
Russ Findlay
Robert Radtke

Utah Reclamation Mitigation Conservation Commission:
Maureen Wilson

Emery County Public Lands:
Ray Petersen

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Emery Water Conservancy District:
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North Emery Water Uses Association:
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Senate Representative:
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Emery County Commissioner:
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Rodger Barton
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San Rafael Conservation District:
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Appendix E.

FINAL
PREVENTING SPREAD OF AQUATIC INVASIVE ORGANISMS COMMON TO THE INTERMOUNTAIN REGION

INTERIM GUIDANCE FOR 2007 FIRE OPERATIONS

The following interim guidelines were developed for fire personnel to help them avoid the spread of aquatic invasive species. The aquatic invasive species considered here were selected based on their current significance in the intermountain area and do not include fish. Because of the large expanses which fire crews travel, the potential to serve as vectors for invasive species is significant. These guidelines are intended for use during the 2007 fire season and will be refined and revised over time.

The table (Aquatic Invasive Species of Concern in the Intermountain Region and Methods of Control) outlines specific disinfection treatments for each species and the sources of information. The table serves as a reference. Included are specific recommendations for fire operations broken down by organism. For additional information, the Appendix provides background and technical information for the recommended chemicals, including supply sources for chemicals and use of swimming pool products. The attached Excel spreadsheet, Technical Chemical Information for Disinfecting Aquatic Invasive Species, gives details and calculates dilutions and relative costs of various products. See the MSDS_all attachment for chemical safety and disposal precautions.

Below are seven guidelines that distill the information in the table and generalize the recommendations to all species:

OPERATIONS GUIDELINES

(1) Obtain maps of where aquatic invasive organisms occur in watersheds where the operation will take place. GIS coverages of individual species for most areas are accessible to biologists, resource advisors, and fire personnel. These GIS coverages are contained in a personal geodatabase ("Invasives Database"—7.2 mb) available for download at http://www.fs.fed.us/r4/workshop/. You can never be certain that invasives are NOT present, but at least you will know ahead of time where they ARE present.

(2) Avoid entering waterbodies or contacting mud and aquatic plants. Avoid transferring water between drainages or between unconnected waters within the same drainage.

(3) Avoid sucking organic and bottom material into water intakes when drafting from streams or ponds.

(4) External equipment surfaces:

(a) Prior to leaving the project site (or, if equipment has been obtained from a source where sanitizing history is unknown), power wash all accessible surfaces with clean water (and ideally, soap, as in a car wash), and completely remove all mud and organics. Weed washers are effective, and can be used to do double duty. This will greatly reduce

the likelihood that any target aquatic invasives are present and chemical treatment of external surfaces is not recommended. However, New Zealand mudsnails may insert themselves in small crevices and resist flushing. Unless vehicles are driving through streams or helicopter buckets scrape up bottom sediments, snails are unlikely to get on external surfaces.

(b) Thoroughly drying equipment is an easy and effective sanitizing method for all the organisms. However, required drying times vary considerably with the species (see Table) and may not be practical for a quick turnaround. Drying may be practical, however, after the incident.

(5) Water tenders, engines, and other equipment with internal tanks:

Intake hoses, pumps, and tanks can be contaminated with infected water or through sucking the organisms (in particular, NZ mudsnails) up from the stream/pond bottom. Disinfect tanks after the incident, and also disinfect tanks before use if equipment has an unknown sanitizing history. First, flush tanks and hoses with clean water and drain to an upland location. Flushing will reduce the concentration of organisms and lower the risk of infection. A rinse with 5% solution of Quat128® (6.4 oz per gal) or its equivalent (see Table and Appendix) will destroy most if not all target invasive organisms. The solution must be in contact with the surface being sanitized for at least 10 minutes.
Two types of chemicals are shown in the Table. Both can be effective. Liquid bleach (such as Clorox) is readily available in supermarkets but evaporates quickly and damages gaskets and canvas gear. Quaternary ammonium compounds (brand names Quat 128® [or 'Waxie'] and Sparquat 256®) need to be ordered from a supplier (see Appendix) but solutions are safe for gear and remain effective for at least a day if not overly diluted or muddied. In addition, both bleach and quaternary ammonium compounds are available in bulk as swimming pool chemicals at reduced cost. See Appendix for details.

(6) Cleaning and sanitizing equipment as described above will be necessary before use as well as after use if equipment has been obtained from a source where sanitizing history is unknown. While operational quality control is beyond the scope of this interim guidance, some sort of equipment check-in system where sanitizing could be documented and guaranteed with certification or tagging would be extremely valuable.

(7) Do not dump treated water into any stream or lake, or on areas where it can migrate into any water body. It would be best to offload treated water to sanitary sewers if possible. All of these chemicals can cause permanent eye damage and skin burns. Check the MSDS's for precautions.